PAL
ROBOTICS

STOCKBOT

RFID Robots
Opening the door
to your real store

StockBot
Opening the door
to your real store

PAL Robotics whitepaper series is designed to provide you with in-depth guidance on the business challenges of today most relevant to you. Here you can take advantage of our experts' specialized knowledge that we have put together. We aim to discuss the issues that matter to you in depth, including current and expected changes in the market, options and solutions. To ask our experts questions or advice, don't hesitate to get in touch with us.

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Introduction

In the world of retail - RFID is bringing huge improvements in automating the tracking of merchandise throughout the whole retail supply chain. The cost of RFID technology has fallen significantly in recent years, making it more accessible to retailers.

Benefits of this technology in retail include the chance to virtually eliminate human error in stock tracking and enable higher inventory visibility.

RFID in retail brings multiple plus points to stores overall, such as being able to provide customers with the products they are looking for.

RFID belongs to a group of technologies referred to as Automatic Identification and Data Capture (AIDC). RFID refers to the use of radio waves to read and capture information. It's a system made up of two-parts: using RFID tags, as well as an RFID reader. RFID tags store information about the product - for example the location in the store where the item is located.

An increase in demand for RFID equipment challenges the role of more traditional handheld inventory readers. More traditional inventory-taking typically involves using a handheld inventory reader, or counting items manually, which can be very time consuming.

RFID robots go a step further by enabling stores to programme regular automated inventory tracking and data collection, bringing numerous benefits.

"Automation in retail is a great way to improve operational efficiency and reduce errors in an industry that is traditionally fraught with them."

Ref. Vue

"The global retail robots market is expected to witness significant growth during the forecast period (2021–2028) due to robotics allowing brick and mortar stores to become more customer-oriented."

Ref. Coherentmarketinsights

01.

RFID robots vs handheld readers

Retail is a fast-changing industry, constantly facing many challenges, one particular challenge directly connected to customer experience, sales, and revenue, is that of tracking products in-store and having accurate inventories.

The most common way to take RFID-based inventories is using handheld devices. Yet in today's retail world there is a range of platforms available using some of the latest technologies to help improve inventory-tracking and in-store operations.

StockBot RFID Robot

RFID Handheld Reader
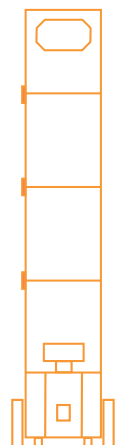
Store and inventory challenges

Challenges related to tracking products in-store
and inventory management include:

Stock data accuracy
Without accurate inventory it's impossible to understand
exactly what's in stock at any given moment.

Inconsistent tracking of items
Using manual inventory tracking procedures takes time and is
prone to errors.

Inventory documentation
Using paperwork to document inventory does not scale easily
across multiple stores.

Visibility of products in stock
When inventory is difficult to locate in the warehouse, it may
lead to inaccurate shipments.

Maximizing space in warehouses
Inventory management platforms help to understand free
space in warehouses ready for deliveries of new stock.

Overstocking of products
Overstocking can lead to cash flow problems and storage
problems such as stock damage.

Slow and inefficient processes
Inefficient, time-consuming and low-tech operating
procedures may be difficult to maintain as operations expand.

History of RFID

The sometimes disputed history of RFID technology goes back as far as World War II, however, RFID was finally patented in 1973, for an active RFID tagging system that utilized rewritable memory *(ref. blog.labtag).* In 1999, many organisations joined together to create the technology for wider use in business. In addition, researchers also developed RFID technology to be used further than assisting in basic inventory management *(ref. medium.com).*

In 2014 a team of engineers developed a new search algorithm that allowed robots to use RFID-technology to improve the robot's ability to find objects labeled with self-adhesive RFID tags *(ref. incompliancemag).* Further research was published on Tracking Dynamic Objects with Long Range Passive UHF RFID Using a Mobile Robot *(ref. journals.sagepub)* in 2015, on the basis that 'Service robots have shown an impressive potential in providing assistance and guidance in various environments, such as supermarkets, shopping malls, homes, airports, and libraries.'
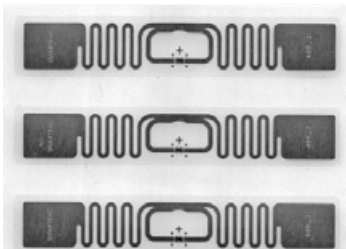
1973
RFID is patented

1999
RFID technology
is developed

2014
Robots are using
RFID technology

2015
StockBot is launched

Comparison of RFID robots vs existing devices for inventories

Barcode scanning

Barcode scanning can be done by using handheld devices - either wireless or wired. Wired scanners are usually more inexpensive than wireless but offer less flexibility. These types of scanners are then plugged into computers that store the inventory information.

Stocktaking apps

These often involve creating and connecting barcodes to the app, to then track inventory on devices such as desktops, tablets or mobiles. App features typically include barcode scanner support, order tracking, item kitting, and customizable product categories.

RFID tracking

RFID tags use more advanced data transmission technology than barcode scanners. Using this technology, it's easy for store employees to find an item, even when there are thousands of items in stock. Reader hardware sends and receives signals allowing it to read and interpret data gathered from RFID tags.


Autonomous robotics

Retail robots capture data about stock and in turn increase efficiency and accuracy in inventory management. RFID robots move around the store and scan items, before providing data on aspects including stock levels, out-of-stock situations, and pricing.

02.

How RFID robots work

RFID robots work by circulating close to products with RFID tags in order to scan them, providing product information that's available for viewing through the robot. They typically include features such as autonomous navigation and obstacle avoidance, autonomous docking and charging, and the ability to schedule inventories as regularly as desired by the customer.
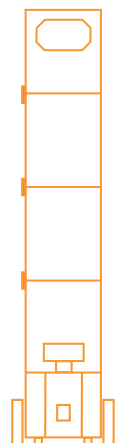
RFID tags, antennas, and readers

Tags

Tags are placed on all items in the store that are for sale. The tag stores information that is tracked by antennas in the RFID robot. In most cases RFID tags are passive (do not require batteries) and respond to the signal waves from the antennas in the passing robot.

Antennas

RFID antennas are typically located on the sides of the RFID robot and have beams to detect tags. The antennas can often detect several tags at the same time, therefore, a robotic RFID inventory system can have the same reading capability as a number of handheld readers.

Readers

A radio frequency identification reader (RFID reader) processes information the antennas have scanned from the RFID tags. The reader filters out unnecessary information such as scanned information that has been duplicated. The RFID reader within the robot then processes the data from the tags to be available to the organisation.

How the robot operates

RFID tags are placed on items
and the robot contains RFID equipment. When the robot is at a certain distance it is able to read the RFID tags and update its system.

RFID robots perform SLAM
RFID robots include additional sensors in particular lidar, and cameras, enabling them to perform SLAM - simultaneous localization (of their own location) and mapping of any area. This technology is able to avoid obstacles, including people and furniture.

The RFID reader emits radio waves through different antennas
so that the signals are bounced back by the tags and received by the same antennas. The approximate location of each tag with respect to the robot is then be calculated by the reader by measuring the distances estimated from each antenna reception time.

As the robot moves it collects data and information from each tag. The RFID robot is able to locate itself inside a store or warehouse continuously.

Increasingly, RFID robots use sensor fusion to merge data from various sensors to increase accuracy of navigation.

03.

RFID Navigation

To navigate, the robot uses RFID tasks as landmarks to help with path planning and initial map creation. The robot is able to automatically move along a path until a tag is found. The robot then refers to the map for where to go next.

With RFID a robot's pose is calculated by information from the RFID tags. Mobile robot navigation systems can typically be split into three types:

Inertial systems
Rotation and acceleration measures are used for positioning information relative to a known starting point

Absolute systems
Provides vehicle position using beacons, landmarks or satellite-based signals

Hybrid or fusion systems
Simultaneous use of more than one navigation system for location determination

RFID solutions are able to plan paths from start point to end point, finding the optimal routes.

RFID ROBOTIC SOLUTIONS INCLUDE

Mapping of areas
Additional sensors allowing them to perform SLAM - simultaneous localization of their own location and mapping of any previously unknown areas. The robot is also able to collect a large amount of data due to its movement around the store.

Obstacle detection
Carried out using ultrasonic sensors. RFID tags are connected to the system and the transmitter is able to provide a respective signal in response. The controller modifies power delivery from a power source to the motor. When the signals received change as a result of part of the magnetic field being blocked, this provides a method of obstacle detection. This technology enables RFID solutions to navigate around moving obstacles and fixed objects.

04.

Benefits of RFID robots

Being able to track stock regularly helps to avoid errors in inventory management, and makes it easier to understand what's in stock and then only order the right amount to meet customer demand. This also helps to ensure that products are not oversold, as well as helping to reduce overstocking.

Sales Trends Identification
Programming regularly inventories also helps to identify sales trends, including data such as volumes of products sold.

Technology cost reduction
As the robot is able to move around the area - to have RFID technology in the area instead would incur higher costs per square meter.

Staff on higher value tasks
Doing inventories by RFID helps to free up staff to work on higher value tasks and to have more time to spend with customers.

Improved customer experience
Tracking stock ensures customers find the products they are looking for at the right time, improving customer satisfaction.

Customer behaviour has changed, with customers more inclined to search for and buy products online, or even confirm product availability in the store before visiting, increasing the importance of accurate inventory management.

Overall, multiple factors including the increase in efficiency, ability to redeploy staff on higher value tasks and a decrease in stock holding costs, help to bring retailers an increase in sales.

Retailers that have adopted RFID tagging have achieved sales increases of up to 10% due to this technology.

Consulting firm Kurt Salmon

05.

RFID use case:
Decathlon

An example of successful deployment of RFID technology through the inventory tracking and data collection solution by PAL Robotics, StockBot is at world-leading sports retailer Decathlon. The StockBot solution was initially deployed in Decathlon, Singapore in 2019. Following the success of this trial, the solution was chosen for use in stores across multiple countries worldwide, including France, The Netherlands, Spain, Portugal, Poland, Ireland, Italy, and Taiwan. Discussions are ongoing for deployment in further countries across Europe and Asia.

StockBot was chosen to assist the team and elevate in-store experience.

Customer needs

Decathlon was looking for a solution to be able to provide accurate data on stock, as well as save time taken to do stock taking manually, impacting on in-store efficiency and productivity. This would allow teammates to spend more time with customers.

Our solutions

Decathlon Singapore implemented StockBot in their store in 2019, followed by roll-out across multiple stores in 2021. The implementation of StockBot allows the company to greatly increase the frequency of daily inventories as the robot is in operation continuously.

Improving the efficiency management of products means reducing costs, reducing response time to product demand, and making decisions with the data provided by automation with a robotic tool. StockBot reads and detects all the products in-store and then provides the data. Using this type of technology helps gain better visibility of stock, and of course, automate inventory tracking and workflow.

Customer benefits

The implementation at the store in Singapore enabled the team to finish inventories in a space of 5000 m2 within 5 hours, in order to then be able to dedicate more time to helping customers.

In addition, all the time and cost that employees spend on taking inventories can be spent on other more value-added tasks such as direct customer service, which, as a result, leads to a better and more complete customer experience.

The retailer has implemented the solution in order to improve in-store operations, as well as helping improve product availability rates.

Now and the future

The StockBot solution helps Decathlon to determine easily and efficiently, a comparison of item sales depending on product placement in-store. Additionally, the use of StockBot has helped Decathlon stores to maintain the success of facilities they offer such as 'click and collect' services.

StockBot is here to read the stock in the store every night so that in the morning, teammates have all stock available on their smartphone. We consider the robot as a new teammate, someone that will help day-to-day, and obviously, to improve their capability to have stock availability. Stock availability is equal to huge benefits for the customer. "

Sébastien Teneveau, RFID Robot Product Owner at Decathlon

The recent roll-out of StockBot in Decathlon stores globally is just the initial part of the collaboration between PAL Robotics and Decathlon. PAL Robotics and Decathlon are discussing potential additional collaborations - not only with inventory tracking and data collection through StockBot, but also RFID use cases in intralogistics, and with other research projects related to robotics and RFID.

PAL Robotics continues to discuss and respond to requests for the roll-out of StockBot in additional countries through Decathlon stores, including further countries in Asia and Europe, as well as increasing the number of orders to stores in existing countries where StockBot is deployed. Thanks to the partnership with Decathlon, PAL Robotics also expects to be able to deploy more capabilities on StockBot.

For any retailer, ensuring that customers are visiting your store and will find the products they are looking for is crucial. "

Mathieu Blanchard Technical Director of Decathlon South East Asia

PAL Robotics expects to be able to deploy more capabilities on StockBot thanks to this partnership.

06.

The future of RFID

RFID in retail is a sector that's growing fast in popularity and there are many predictions for its future. In some ways the RFID revolution in retail is still in its infancy. As well as retail, RFID technology is also used in sectors such as logistics, manufacturing and healthcare.

Here are some predictions

Flexible RFID tags

Thinner and more flexible RFID tags will enable tags to be implemented in places that would previously have been difficult to reach.

Cloud-based storage

More widespread use of cloud-based storage with RFID technology - that makes it easier and quicker to access and check stock.

Chipless RFID tags

Chipless RFID tags are starting to establish some market share. This also means that organisations may in future be able to print their RFID tags just like barcodes today.

Monitoring temperature

There is also potential for RFID to check temperature and other factors that may influence operations throughout the supply chain.

RFID's global market
is estimated to reach

USD **17.4 billion** by 2026
annual rate 10.2%

Ref. Technowave

07.

To introduce RFID robots, what's next?

PAL Robotics' StockBot solution is flexible and easy to integrate with your company's systems. StockBot uses web-based tools and no additional tools are needed. The solution also adapts to customers in-store and is suitable for use during open hours.

Set up in a single day

01. StockBot creates your map
Start moving StockBot with the remote control, so that the robot gets to know the space. Later you can view the map through the Web User Interface.

ⓘ StockBot will adapt to most of your in-store layout changes.

02. StockBot finds optimized routes
Show the robot the paths you would like it to take through store areas using the remote control, or StockBot can generate paths itself through furniture detection.

ⓘ StockBot navigates on different types of surfaces including ramps.

03. StockBot starts work
Choose tasks for different areas of your store, selecting the day, start time etc. StockBot will carry out its work while allowing your customers to shop freely around your store.

StockBot provides Quality Control data such as information on time used for tasks, routes taken in the store, and the areas covered.

Conclusion

In conclusion, in the past-paced and dynamic world of retail, new technology, including RFID, helps retailers to gain a competitive advantage. RFID robotics make it possible to closely monitor inventory, which brings multiple benefits.

Reducing overstocking helps stores to manage costs more effectively, whilst RFID enables stores to better understand sales trends, and improve customer experience by being able to track products to ensure customers can find and buy what they are looking for.

Additionally, RFID robotics allow stores to re-assign staff to higher value tasks such as helping customers, whilst saving time with automating regular and reliable inventories.

RFID technology in robotics also brings with it further opportunities for stores, for example, improving money-mapping, store floor management, shelf analytics and planogram compliance. Use cases for RFID in a wider retail context include receiving goods in warehouses, as well as use of RFID in areas such as logistics or manufacturing.

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Thank you for reading this whitepaper and we hope you found the information here useful. If you are looking to incorporate RFID robotics in your store, we will be happy to guide you with our expertise.

For more information,
visit our website or get in touch with us.
info@pal-robotics.com

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Leading robotics advancements since 2004

Our mission is to enhance people's quality of life through service robotics and automation technologies. Since 2004, we have designed and manufactured highly integrated and reliable solutions for service industries and research institutions. PAL Robotics has solutions that are used worldwide for industry, logistics, service and retail.

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